

AN ANNOTATED CHECKLIST OF THE AQUATIC AND SEMIAQUATIC DRYOPOID COLEOPTERA OF CALIFORNIA

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Abstract. — All the species of aquatic and semiaquatic dryopoid Coleoptera known to occur in California are listed. Genera with identification problems and undescribed species are indicated. Factors that might influence the collection of species, such as ecological preferences and/or annual occurrences of certain life stages, are cited.

Key Words. — Insecta, Coleoptera, Dryopoidea, Elmidae, Psephenidae, Dryopidae, Limnichidae, Ptilodactylidae, Eulichadidae, Heteroceridae, distribution, habitat

Various families in the superfamily Dryopoidea have evolved to take advantage of a diversity of aquatic and semiaquatic habitats. Most species of water-associated dryopoids are found in streams and rivers. Others, however, are found in seeps and springs, in lakes, in and on riparian vegetation, and in and on the mud and sand margins of water bodies. California has a particularly rich dryopoid fauna (Table 1), perhaps richer than any other area in North America. This undoubtedly reflects the very diverse ecology of California, as well as its great north to south length. Similar richness is seen in Plecoptera (Table 2) and in aquatic and semiaquatic Hemiptera (Table 3), the only other orders for which appropriate distributional information is available. Even with this known richness, many new species of aquatic insects are still being discovered in California. Another factor adding to the richness of the dryopoid fauna is that various elements from the dryopoid faunas of the Nearctic, Palaearctic, and Neotropical biogeographic regions meet in the state. Nowhere else on the continent do these elements so combine.

This list was compiled because California, like many other areas, has seen an upsurge in studies of stream ecology, water pollution, impact of logging, etc. These studies have been hampered by workers not knowing just which species occur in the state. Another part of the impetus for this checklist was requests for information on rare or endangered status of dryopoid species.² Only two previous publications (Usinger et al. 1956, Brown 1972) have attempted to list California dryopoids. Both are now out-of-date. Thus an updated list is warranted, although many taxonomic problems remain; I am developing identification keys to the species here.

The general ecology of aquatic and semiaquatic dryopoids has been well addressed by Brown (1987). I have tried to indicate under each genus (family in two cases) where the larvae and adults are most apt to be collected, at least as indicated

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² Most species for which more data were needed appeared rare because of insufficient collecting. Only two, *Dubiraphia brunnescens* (Fall) and *Microcylloepus formicoides* Shepard, both from a single locality, now deserve a protected status.

Table 1. Number of genera and species of aquatic and semiaquatic dryopoid Coleoptera in North America and California. Number in parentheses is the percentage of the North American number.

Families	North America		California	
	Genera	Species	Genera	Species
Elmidae	26	95	14 (54)	23 (24)
Dryopidae	4	13	3 (75)	5 (39)
Limnichidae	7	31	6 (86)	13 (42)
Psephenidae	6	15	3 (50)	3 (20)
Heteroceridae	9	31	6 (67)	9 (29)
Eulichadidae	1	1	1 (100)	1 (100)
Ptilodactylidae	3	3	2 (67)	2 (67)
Totals	56	189	35 (63)	56 (30)

by my experiences. Most genera and species are rather catholic in microhabitat choice(s). A few (i.e., *Atractelmis*, *Dubiraphia brunnescens*, *Araeopidius*, *Thros-cinus*) appear to be very habitat-specific.

FAMILY ELMIDAE

SUBFAMILY LARAINAE

Tribe Laraini

Lara LeConte 1852

- Lara avara* LeConte 1852
- Lara gehringi* Darlington 1929

These two species will probably be synonymized at a later date unless new distinguishing characters can be discovered. As yet, there are no characters that consistently separate the taxa. Larvae gouge soft submerged wood; adults are typically on log-jams and debris piles, or on the undersides of undercut stream-banks.

SUBFAMILY ELMINAE

Tribe Elmini

Ampumixis Sanderson 1954

- Ampumixis dispar* (Fall) 1925

This species is quite variable in elytral color pattern, ranging from all red, to having red maculae of variable size, to all black. The relatively long legs give it a spidery look. Both larvae and adults occur in higher, cooler mountain streams.

Atractelmis Chandler 1954

- Atractelmis wawona* Chandler 1954

Once considered quite rare, this species is now known to be widespread in the northern half of the state (Shepard and Barr 1991). Larvae and adults particularly prefer submerged mosses, but they have been taken on roots of riparian vegetation.

Table 2. Number of genera and species of Plecoptera (stoneflies) in North America and California. Number in parentheses is the percentage of the North American number. Data from Stewart & Stark (1988).

Families	North America		California	
	Genera	Species	Genera	Species
Capniidae	9	132	6 (67)	29 (22)
Leuctridae	7	52	5 (71)	10 (19)
Nemouridae	11	64	6 (55)	15 (23)
Taeniopterygidae	6	32	4 (67)	9 (28)
Chloroperlidae	12	73	9 (75)	24 (33)
Peltoperlidae	6	18	3 (50)	6 (33)
Perlidae	15	48	4 (27)	5 (10)
Perlodidae	29	118	18 (62)	34 (29)
Pteronarcyidae	2	10	2 (100)	3 (30)
Totals	97	547	57 (58)	135 (25)

Cleptelmis Sanderson 1954

- Cleptelmis addenda* (Fall) 1907
- Cleptelmis ornata* (Schaeffer) 1911

These two species may be synonymized in the future unless good distinguishing characters are found. Large enough population samples of each almost always include individuals with the color pattern of the other species. I have found no difference between the genitalia of the two species. Both the larvae and adults occur most often in roots and moss.

Dubiraphia Sanderson 1954

- Dubiraphia brunnescens* (Fall) 1925
- Dubiraphia giulianii* (Van Dyke) 1949

These two species may be synonymized due to overlapping characters. Although most individuals of each species are distinguished by different color patterns, some specimens of *D. giulianii* have been found with the color of *D. brunnescens*. *Dubiraphia brunnescens* appears to be restricted to Clear Lake (on willow roots), Lake County, while *D. giulianii* occurs widely over the state. Larvae and adults occur on roots of riparian vegetation, and on submerged macrophytes. Larvae can be particularly hard to locate.

Heterelmis Sharp 1882

- Heterelmis obesa* Sharp 1882

Table 3. Number of genera and species of aquatic and semiaquatic Hemiptera in North America and California. Number in parentheses is the percentage of the North American number. Data from Menke (1979).

	North America	California
Genera	65	36 (55)
Species	415	113 (27)

This very distinctive elmids has, so far, been collected in only a few spring-fed canyon streams in the Mojave Desert of far southeastern California. It represents one of the Neotropical lineages whose distribution just enters our area. Although preferring submerged wood, larvae and adults may be taken in many microhabitats.

Heterlimnius Hinton 1935a

Heterlimnius corpulentus (LeConte) 1874

Heterlimnius koebeli (Martin) 1927

One of the main characters distinguishing these species is the number of antennal segments, *H. corpulentus* having 10 and *H. koebeli* having 11. The area of concern is between the pedicel and the club—*H. corpulentus* has five segments there, while *H. koebeli* has six. Unfortunately a number of specimens have been found having 10 segments on one side and 11 on the other side. Other antennal aberrations have also been found. Both larvae and adults are commonly found in gravel. They typically occur in cold, higher-elevation streams, where they replace *Optioservus* spp.

Microcylloepus Hinton 1935a

Microcylloepus formicoideus Shepard 1990

Microcylloepus similis (Horn) 1870

This genus is in need of revision. Problems involve the numerous populations isolated in springs and spring-fed streams on the east front of the Sierra Nevada, and in the Basin and Range Desert. I presently find it difficult to understand the morphological variation, both external and genitalic, between and within the populations. A confounding factor is that many of these populations occur in warm springs where the constant warm environment may be contributing to morphological changes simply by altering developmental times. However, with all these factors in mind, I still think that a third, as yet undescribed, species occurs widely across an area south of Lake Mono from the east front of the Sierra Nevada to the eastern border of Nevada. Both larvae and adults occur in a variety of microhabitats in warm streams and springs.

Narpus Casey 1893

Narpus angustus Casey 1893

Narpus concolor (LeConte) 1881

Narpus concolor is far more variable in its size, shape, and size of maculae than is *N. angustus*. Fortunately adults of these two species do not often co-occur. In both species the larvae and adults are also generally not found occurring together in any great number. I have yet to understand the microhabitat requirements of the larvae. *Narpus angustus* adults are more typical of larger rivers in the various mountains in the northwestern part of the state. They can be especially abundant where bars of coarse gravel drop off into deep pools. Adults of *N. concolor* are more often found a few at a time in the gravel and litter in small streams.

Optioservus Sanderson 1954*Optioservus canus* Chandler 1954*Optioservus divergens* (LeConte) 1874*Optioservus heteroclitus* White 1978*Optioservus quadrimaculatus* (Horn) 1870*Optioservus seriatus* (LeConte) 1874

A particularly troublesome problem exists here in separating *O. quadrimaculatus* from *O. seriatus*. Although individuals of both species appear different, no consistent distinguishing character has been found. A similar problem exists with *O. divergens* and *O. heteroclitus*, whose distinguishing characteristics seem only to relate to size. The break between the sizes of the two species appears to me to be rather artificial. Larvae and adults of all species are typically found in gravel in warm to cool streams.

Ordobrevia Sanderson 1953*Ordobrevia nubifera* (Fall) 1901

The characteristics of this species are more variable than originally described and the variability may be controlled by water temperatures (Shepard 1992). Both larvae and adults are typically found in gravel and under boulders in the faster parts of streams.

Rhizelmis Chandler 1954*Rhizelmis nigra* Chandler 1954

Occasional specimens are bimaculate or quadrimaculate. Quadrimaculate specimens with large maculae have the elytra appear banded with red. These specimens strongly resemble *Ampumixis dispar* (which is very closely related) and some *Heterlimnius koebelei*. Although widespread, this species is relatively uncommon. Both larvae and adults seem to prefer coarse gravel substrates in cool, small-to-medium sized streams. However, I have collected too few specimens to feel confident that they do not like other microhabitats.

Zaitzevia Champion 1923*Zaitzevia parvula* (Horn) 1870

A second, undescribed species is known to occur in the northcentral part of the state. Larvae and adults occur in gravel in most streams.

Undescribed Genus

Recently specimens of an undescribed genus and species have been found in cool mountain streams in northwestern California. This genus was first collected (in Oregon and Washington) and recognized as new a few years ago by Cheryl B. Barr. The California specimens appear to represent an additional species in this new genus. This genus has close affinities with *Cleptelmis*, *Ampumixis* and *Rhizelmis*. Like these other genera, the larvae and adults of the new species show a decided preference for aquatic mosses.

FAMILY DRYOPIDAE

Dryops Olivier 1791

Dryops arizonensis Schaeffer 1905

Adults occur on emergent material and readily come to lights at night. This species has only been found along the border with Mexico (H. P. Brown, personal communication).

Helichus Erichson 1847

Helichus columbianus Brown 1931

Helichus suturalis LeConte 1852

Larvae are now known to be terrestrial (Ulrich 1986); adults are found in many stream microhabitats, but particularly associated with roots, and debris piles containing leaves and sticks.

Postelichus Nelson 1989

Postelichus immsi (Hinton) 1937

Postelichus productus (LeConte) 1852

Habitat as for *Helichus* spp. *Postelichus* occurs in the warmer streams of the southern part of the state, and north in the Coastal Mountains almost to the Bay Area.

FAMILY LIMNICHIDAE

Adults are riparian. They are commonly found on vegetation overhanging the water, on sand and mud bordering the water, and on various materials in the strandline. Only a single larva has been collected in the Nearctic region. It was in a cell under moss just at the edge of the water.

SUBFAMILY LIMNICHINAE

Tribe Limnichini

Limnichoderus Casey 1889

Limnichoderus lutrochinus (LeConte) 1879

Limnichoderus naviculatus (Casey) 1889

Lichminus Casey 1889

Lichminus tenuicornis (Casey) 1889

Eulimnichus Casey 1889

Eulimnichus analis (LeConte) 1879

Eulimnichus californicus (LeConte) 1879

Eulimnichus evanescens Casey 1912

Eulimnichus montanus (LeConte) 1879

Eulimnichus perpolitus (Casey) 1889

Limnichites Casey 1889

Limnichites foraminosus Casey 1912

Limnichites nebulosus (LeConte) 1879

Limnichites perforatus (Casey) 1889

Tribe Bothriophorini

Physemus LeConte 1854*Physemus minutus* LeConte 1854

SUBFAMILY CEPHALOBYRRHINAE

Throscinus LeConte 1874*Throscinus crotchi* LeConte 1874

Adults are intertidal and found on mudflats in southern California.

FAMILY PSEPHENIDAE

Larvae are flattened, coppery in color, and more-or-less circular in outline; thus their common name, water penny, is apt. Larvae are most commonly found on rocks, but they may be on wood. Adults are terrestrial and riparian, and located near the streams. Once mated, females crawl underwater to oviposit. Adults are only found during the summer months.

SUBFAMILY EUBRIANACINAE

Eubrianax Kiesenwetter 1874*Eubrianax edwardsii* (LeConte) 1874

There may be more than one species in the state as one population has recently been found pupating underwater. This habit is typical for some species from Taiwan (Lee & Yang 1990). *Eubrianax edwardsii* pupates away from the stream. Adults may be found on streamside vegetation or flying nearby.

SUBFAMILY EUBRIINAE

Acneus Horn 1880*Acneus quadrimaculatus* Horn 1880

Although only this species is definitely known from California, the other three species in the genus may occur in the far northern part of the state. They are known from southern Oregon (Fender 1951, 1962). Adults may be found on riparian vegetation.

SUBFAMILY PSEPHENINAE

Psephenus Haldeman 1853*Psephenus falli* Casey 1893

Although pupation normally occurs away from the stream, one population has been found pupating underwater. Adults may be found on wet emergent parts of boulders in fast currents.

FAMILY PTILODACTYLIDAE

The larvae are aquatic and occur in seeps, springs, and streams. The adults are terrestrial and only occur during the late spring through summer months. Adults are most commonly swept from riparian vegetation.

Anchycteis Horn 1880

Anchycteis velutina Horn 1880

Adult specimens that I have seen were from widely scattered locations across northern California. Larvae are uncommon in the gravel of mountain streams.

Araeopidius Cockerell 1906

Araeopidius monochus LeConte 1874

Although occurring widely in northern California, more specimens are collected in the Coastal and Cascade Mountains than in the Sierra Nevada. The single larva that I have collected was in a muck-filled seep.

FAMILY EULICHADIDAE

Stenocolus LeConte 1853

Stenocolus scutellaris LeConte 1853

Larvae occur under rocks and in leaf packs in streams and rivers. Larvae are common and have been collected widely across northern California. Adults have been collected infrequently.

FAMILY HETEROCERIDAE

Larvae and adults of all species are riparian. They occur on mud and sand flats. There they tunnel through the substrate, ingesting all material and digesting the organic portion. They can be collected during the warmer months of the year.

There is disagreement over generic status within the family. Pacheco (1964) elevated various species groups to genera. Miller (1988), however, prefers to retain the single genus *Heterocerus*, and to recognize species groups only as such. Either way, the morphological similarities between species make identifications difficult, at best.

Tribe Augyliini

Microaugyles Pacheco 1964

Microaugyles mundulus (Fall) 1920

Tribe Heterocerini

Lanternarius Pacheco 1964

Lanternarius brunneus (Melsheimer) 1844

Lanternarius gemmatus (Horn) 1890

Lanternarius parrotus Pacheco 1964

Lanternarius sinuosus Pacheco 1964

Neoheterocerus Pacheco 1964

Neoheterocerus gnatho (LeConte) 1863

Dampfius Pacheco 1964

Dampfius mexicanus (Sharp) 1882

Lapsus Pacheco 1964

Lapsus tristis (Mannerheim) 1853

Tribe Tropicini

Tropicus Pacheco 1964*Tropicus pusillus* (Say) 1823

UNCERTAIN STATUS

Heterocerus Fabricius 1792*Heterocerus unicus* Miller 1988

This species fits into the *H. undatus* group that Pacheco calls *Dampfius*.

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